A SURVEY REGARDING THE NEWEST SEEDLINGS PLANTING TECHNOLOGIES THAT CAN BE USED IN AGROFORESTY, LANDSCAPE ECOLOGY AND FOREST REGENERATION FIELDS

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ABSTRACT

Nowadays the seedlings planting technologies are design to raise mechanization performance on forestry and pomiculture works. Their impact is manly on soil remediation, lowering the surface and depth erosion degree, capitalization of rainwater, lowering the dust pollution and natural calamity risk and the rehabilitation of inland flora. In this paper will be presented some of the most performant planting technologies, which can be used in the environmental management process that assures high establishment rate. In some cases, the ecological benefits can occur after a shorter period of time reducing considerably the calamity risks, encouraged the inland flora, forest and degraded the site restauration, but also landscape ecology.

INTRODUCTION

Real figures could be much higher, because officials also consider as “forest” the places where is forestry vegetation, namely seedlings only a few centimetres tall, as in Figure1, but as deforestations have put down over half of million hectares. The total area covered by forest could rather be around 5 million hectares, Figure 2, representing only 20% of Romania’s surface, and the ecological disaster, according to some journalists “is caused by private forests owners who have triggered the slaughter of Romanian forests”. (Vișan A.L., at all, 2016)

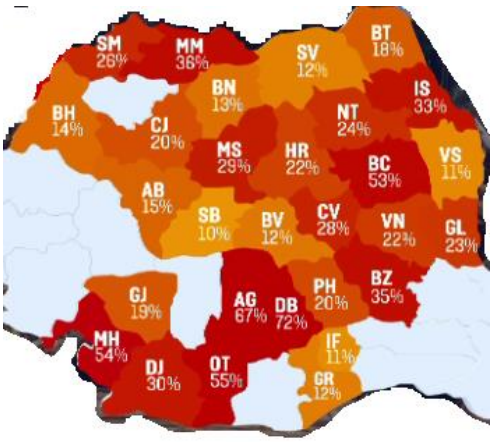

Figure 1 Map of risk areas and illegal deforestation.

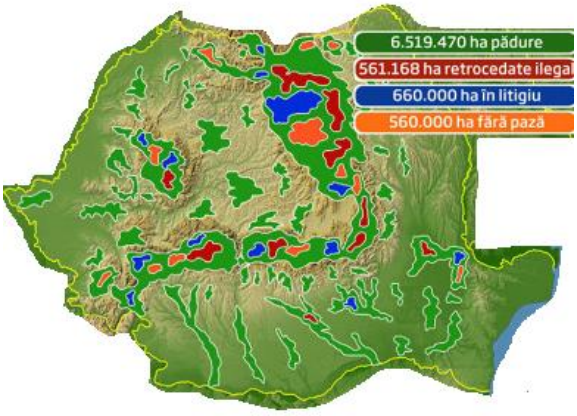

Figure 2 Romanian forest fund situation in 2013

The impact of afforestation technologies of degraded lands is underlined in European and national strategies, for this reason are financed

projects to eshatblishment large infrastructure for historically polluted sites and abandoned degraded lands that have as specific objectives the regional development of unfavorable areas and decreasing the ecological disasters risks. In this way the afforestation technology of degraded slope lands can be successfully implemented within these projects, which can be proposed both by institutions and profile organizations, but also by private forest owners.

In this line the INMA institute had has proposed to finance a project to develop innovative technology for setting up green infrastructure on degraded slopes.

Having in view, that the percentage forests distribution is higher in mountain areas, Fig. 3, these are the areas that are prone to ecological disasters due to the lack of green infrastructure and poor management.

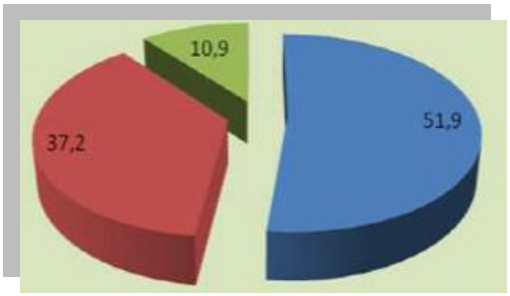

Figure 3 Forest fund distribution depending on landforms (gren zone – Plain, red zone -hills, and blue zone – mountains)

Taking in to consideration that the degradated terraines are present in all relief formulas and each of them has specific flora and fauna, Figure 3, it has been required that this technology can be easily adapted to all establishment criteria (of: air, water, soil, climate, pollution, etc.), but also of the operator that implements this technology, Figure 4.

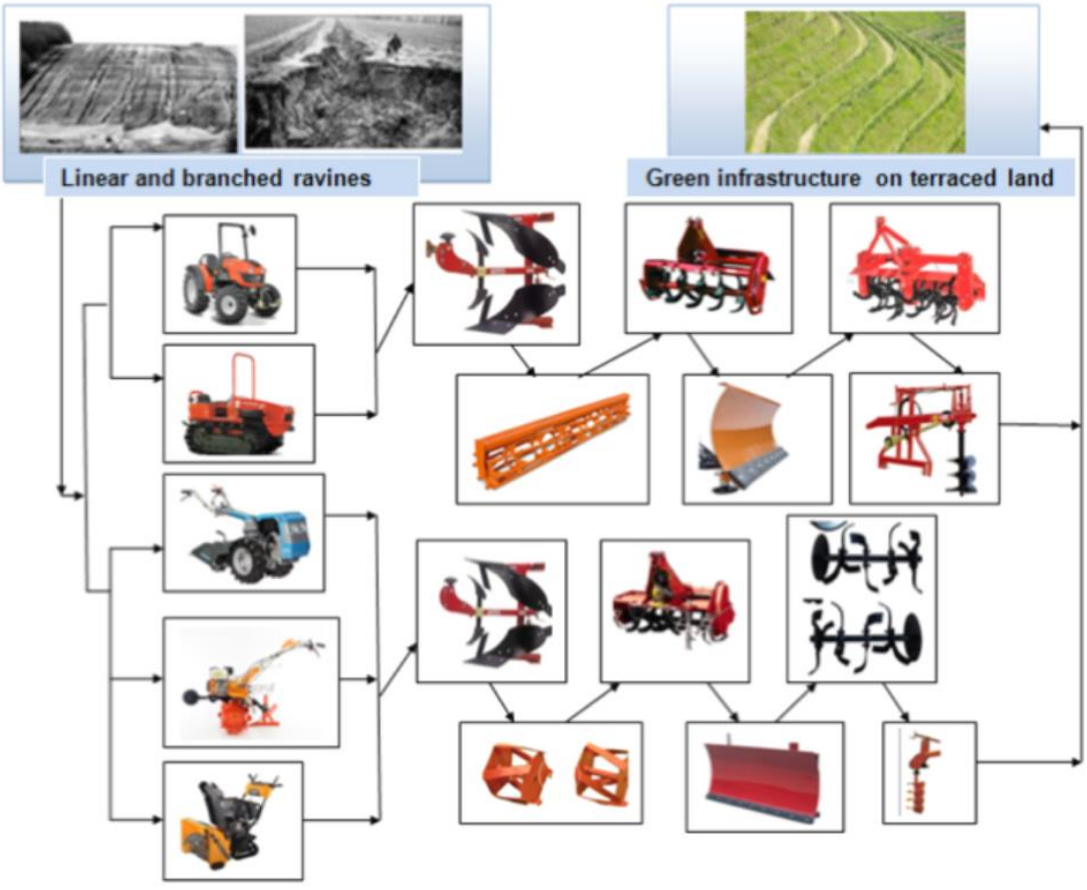

Figure 4 Innovative technology for the afforestation of degraded slope lands

Depending on the surface and technology enforced, the soil works consist in: entire surface works (scraping and grinding of the untilled soil, sub-soiling, harrowing and tillage); partial works in strips or bands (in plain regions),

in strips or bands (in hill regions) and in grates (in mountain region, on rough lands).

Usually, the hardest conditions to apply any kind of mechanical equipment to make landscape ecology, restoration pd degraded sites, restauration of forest and its habitats, are the slope degraded lands, that from technical point of view must be subject to works terracing, see Figure 5.

This recommendation is made because the land is usually unstable and can cause landslides or other forms of mass gravity displacements.

If the slope land is organized in terraces, it encourages water infiltration in the soil in loose strips of land in the areas of the terrace is favored, this way ensuring an additional pluvial water supply for the saplings planted on those.

The volume of water that it can be If the slope land is organized in terraces, it encourages water infiltration in the soil in loose strips of land in the areas of the terrace is favored, this way ensuring an additional pluvial water supply for the saplings planted on those. The volume of water that it can be retained by them is scientifically proven and the indicated values are: for a 10 % (9 ^{0}) terrace counter-slope it can collect approximately 17 [l/m^3] and for 15% (13.5 ^{0}) counter-slope respectively 25 [l/m^3].

MATERIAL AND METHOD

From technical point of view, the drilling equipment's are provided with dedicated augers, especially designed for various kinds of degraded soil. The most representative augers models are made by McMillen and skid steer, the most experienced company from this field. in the next paragraph are presented most appropriate models, Figure 5.

In case of counter-slopes bigger than 25 ^{0}, it is not indicated to use tractors as power source because more risks appear during operation:

- the risk to deteriorate the angle of the terrace achieved on degraded lands due to the possibility for the resistance structure of the tractor to get in contact with the terrace and generate landslides, situation shown;
- the risk of working accidents and equipment deterioration in the situation where the soil is unstable (high moisture or sandy soil) and under the action a higher weight.

Regarding the assumptions made above, here is presented a study on the use of this innovative technology depending on the particularities of the degraded slope land. The efficiency of works executed on slope lands higher than 15 ^{0} is superior because the moisture deficit can be prevented by using this technology, especially in the case of excessively eroded mountain slopes. This study was necessary regarding the opportunity of using small size tractors or motocultivators, when they are used on the terraces counter-slopes achieved on the degraded soil at 15 ^{0} respectively 25 ^{0}.

The levelling operation it can be use the motocultivator as power source, because the forwarding resistance forces are considerably reduced compared to the tractor. If the operation of levelling the counter-slopes of terraces is analyzed from the technological point of view is observed that for a terrace up to 15 ^{0} counter-slope, there are no notable operating problems, and for a counter-slope between 15 – 25 ^{0}, the levelling process is made in multiple passes (because the volume of dislocated and displaced land is considerably increased).

If the counter-slope is achieved, the energy source follows its profile and from this reason is necessary that the drilling equipment that achieves planting dwellings to be set on inclination equal to the achieved counter-slope (case in which the terrace has a counter-slope angle higher than 15 ^{0}), fact that leads to

plant the seeding material on vertical direction. In order to fulfil those conditions, is required that drilling equipment to has a positioning system so the planting dwellings to be easily orientated in accordance with counter-slope angle. Thus, the optimal growth conditions of the planted seedlings with or without earth ballot are created.

In the process of achieving planting dwellings using appropriated augers, at the end of the operation, around the dwellings, appears an earth torus (brink) that can be subsequently used for covering the root system, Figure 6 and 7.

When the dwelling is achieved on a maximum counter-slope of 25 ^{0}, there is the possibility for the earth brink extracted to slide downstream. This situation should be avoided to prevent the bonding effect in the sapling's vicinity.

Based on these observations, it can be concluded that, the equipment for achieving sockets is indicated to move on counter-slopes of max. 15 ^{0}, so that the inclination angle does not have a negative effect on the development of sapling and in stabilizing lands thus afforested.

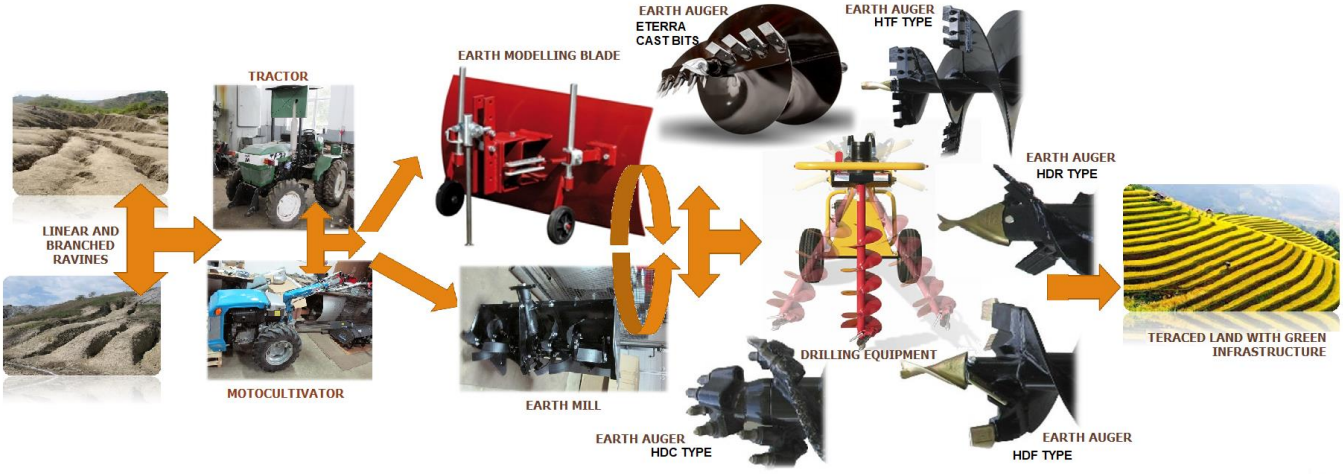

Figure 5 Green eshtablishment innovative technology for terraced degraded slope lands

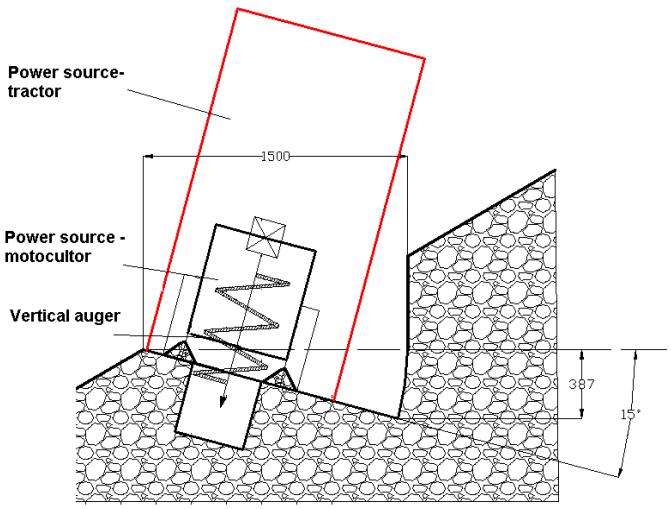

Figure 6 Market drilling equipment working on 15^0 counter-slope terraces

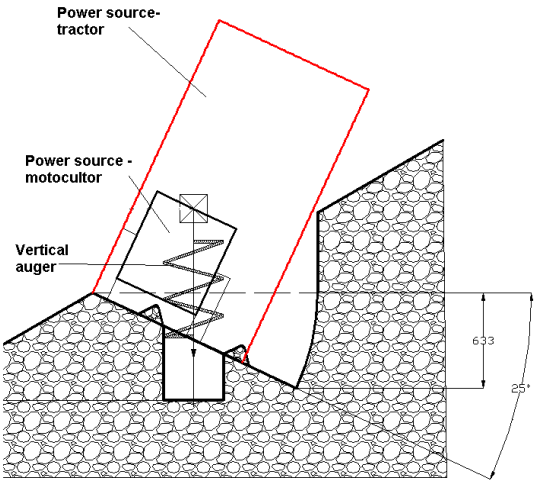

Figure 7 BM working conditions during the planting procedure on 25^0 counter-slope terraces

The drilling equipment developed by INMA Bucharest presents several innovative solutions that were subject of several patent applications.

The BM was implemented an "Auger positioning system designed to achieve planting dwelling in sloping lands", technical solution subject of an OSIM patent application no. A 00705/05.10.2016 and tested in field experimental conditions and in exploitation Figure 8 (Bogdanof at al., 2017). Also due to experimentation activities were patented other two technical solutions necessary to implement on BM equipment in order to increase its adaptability and functionality, namely: "Deviation compensation device of drilling operation that uses a guided auger by a parallelogram mechanism" and "system for rapid mounting and damping the axial shocks of the drill for making the planting holes".

All these patents were presented at national innovation fairs and obtained third place, bronze medal.

RESULTS AND DISCUSSIONS

Experimental research activity conducted had validated this technology and the constructive solutions adopted at LM and BM equipment's, Figure 8.

In Figure 9, is presented the possibility to work with drilling equipment powered by the motocultivator on 25 ^{0} slope degraded terrain case in which the terrace is missing, this possibility is to establish forest belts along transport infrastructure, irrigation channels, green fences, viticulturally plantations, fruit plantations and so on.

Figure 8 Experimental procedure during the working conditions on 25^{0} counter-slope terraces

Figure 9 Experimental procedure to test the drilling equipment on 25^0 slope degraded terrain

Normally, the results of the implementation of this innovative technology can be observed after a certain period of time, at least a year, during which the seedlings develop their root system and crown. Depending on the development of branches and leaves, it can be determined whether the root system has a normal evolution.

The innovative technology was also tested in other two working conditions:

- on plain degraded land, Figure 10
- on greenhouse conditions, Figure 11.

Saplings of fruit trees planted on slope land had a good development and the second year since planting are ready to enter the fruit, figure 10. Those who were planted under greenhouse conditions, the dwarf cherry, after one year had a slower development, Figure 11.

Figure 10 Innovative technology tested on plain degraded land

Figure 11 Innovative greenhouse technology – imagines from the experimental field

General considerations regarding the two operating manners:

- The tractor gauge is higher than that of motocultivator;
- the power generated by the tractor is higher than the one of motocultivator;
- the motocultivator can be fitted with maximum two independent PTO's, for the most performing models;

- tractors have a PTO for mechanical, hydraulic and pneumatic drives;
- the manoeuvrability of a motocultivator is higher, but the operator can be placed in difficult working situations, especially when the soil is very degraded and unstable;
- the tractor can have more automation systems than a motocultivator.

If this technology is used in greenhouse conditions, must be taken special measures to ensure optimal ventilation conditions and to make oxygenation frequent breaks, because it was noted that is a real risk that the operator will become intoxicated with exhaust gases

CONCLUSIONS

Reviewing the “strengths” of our country, we can state that it is opportune to develop the innovative technology for the afforestation of degraded slope lands in order to install infrastructure due to European directives regharding remediation and reconditioning the environment conditions, national development and research strategies; due to national statistics that show a general tendency for deforestation in mountain areas; the possibility to produce superior quality seeding material of producing units; vast experience in RDI activities in the field of fruit growing/forestry of research institutes in programs dedicated to these directions, as well as encouraging and sustaining activities of stopping, remedying and ameliorating degraded slope lands, for preventing disasters and the disappearance of areas with indigenous flora and fauna, as well as promoting innovative technologies for the afforestation of degraded slope lands that comply to national and European development policies.

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